Short note

Naturalised status of *Solanum furcatum* in New Zealand

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Abstract

Solanum furcatum Dunal is recorded as a naturalised species from the Kaikoura region of the South Island, New Zealand. Small populations exist at Whale Bay near the head of Kaikoura Peninsula, at Lyell Creek in the Kaikoura town, and at Goose Bay south of Kaikoura. More extensive populations occur along three kilometres of the Hapuku River north of Kaikoura and on the lower south-eastern slopes of Mt Fife.

Keywords: *Solanum furcatum* - nightshades - naturalised plant - New Zealand - flow cytometry - glycoalkaloids.

Introduction

The *Solanum* genus is represented in the flora of New Zealand by three indigenous species and 17 naturalised species (Webb *et al.* 1988, pp. 1237-1254). In addition, a few other species have been collected on single occasions, but never reported as establishing self-sustaining populations. One of these species is *Solanum furcatum* Dunal, collected once by W.R. Sykes in 1970 behind a beach, north of the Hapuku Bridge near Kaikoura in Marlborough (voucher specimen CHR 201167). This paper reports five distinct small populations of *S. furcatum* that have maintained themselves for up to 12 years in the Kaikoura region. Distribution notes associated with these five populations are reported, along with the distinct morphological, genetic and biochemical attributes of *S. furcatum*. Based on the herbarium specimens deposited during this study, *S. furcatum* has been recently considered as fully naturalised in New Zealand (Heenan et al., 2004).

Population locations

Hapuku River

A small population of 10-12 well established plants and several seedlings were observed under *Kunzea ericoides* on the north side of the State Highway One bridge in December 1995 (voucher specimen CHR 483161). A few plants were also found at this site in December 1996, April 2000 and October 2006. A further 50-60 well established plants and many seedlings were also observed under scrub behind the beach at the mouth of the Hapuku River in December 1996. Similar populations were also observed at this site in April 2000, April 2003 and October 2006. Scattered plants were also observed along the three kilometres of the true left bank of the Hapuku riverbed between these two sites during in December 1996, April 2000 and October 2006.

Lyell Creek

In January 1995 several well established specimens were observed on the true right bank at the mouth of Lyell Creek (voucher specimen CHR 515985). The same individuals were still present in December 1996, along with numerous small flowering plants (voucher specimen CHR 483160). At this time scattered specimens were also observed behind the buildings along both sides of the main business street in Kaikoura (Westend). In April 2000 many of these plants had been eliminated by a herbicide application and landscaping activities, with only a few seedlings apparent. Several plants remained behind commercial buildings of the main business street in October 2006.

Whale Bay

A small population of 10-12 well established plants was observed in December 1996 at Whale Bay at the head of Kaikoura Peninsula (voucher specimen CHR 515952). Most of these individuals grew under scrub (mainly *Melicytus ramiflorus* and *Macropiper excelsum*) and had been heavily grazed by sheep. Only a few of these plants were evident in April 2000, although other scattered plants were observed all along the head of Kaikoura Peninsula. However, in April 2003 over 25 plants, again heavily grazed by sheep, were found in Whale Bay.

Mt Fife

In April 2003 a population of at least 50 well established plants were observed on the lower south-eastern slopes of Mt Fife (voucher specimen CHR 567192). Most plants were growing on waste areas of farmed land and along the edge of native vegetation. Scattered plants were also observed at the end of Mt Fife Road in October 2006.

Goose Bay

A small population of six-eight plants was observed in October 2006 at Goose Bay, 15 km south of Kaikoura. All these plants were growing within a few meters of the State Highway One. Plants were not observed at this site in either December 1995 or April 2000, despite extensive searches on both occasions.

Distinguishing features of *Solanum furcatum*

Solanum furcatum, originating from South America, belongs to the *Solanum* section of the *Solanum* genus, a group of species containing many of the weedy nightshade species in New Zealand (Webb *et al.* 1988, p. 1240). Of the nightshade species present in New Zealand, the mature plants of *S. furcatum* generally had a subshrub habit similar to *S. chenopodioides*,

especially when growing under shade. However they are readily distinguishable from *S. chenopodioides* by the absence of soft grey tomentose on the foliage. Some plants, especially those growing on exposed sites, had a more straggling, lianoid habit. Seedlings and plants with a herbaceous habit closely resemble *S. nigrum*, but can be readily distinguished by the forked inflorescence, larger flowers and prominent stone cells in the fruit.

Solanum furcatum is known to be a hexaploid species (2n = 6x = 72+; Edmonds 1977). Flow cytometry analysis of leaves using standard methods (Morgan *et al.* 1995) revealed a genome size of 8.1 ± 0.1 pg DNA/2C nucleus for *S. furcatum* plants growing at the Hapuku River. A similar genome size was measured for *S. nigrum* plants growing at Lincoln, Canterbury (7.4 ± 0.1 pg DNA/2C nucleus), another hexaploid species (Edmonds 1977). All other nightshade species of the subgenus *Solanum* in New Zealand (*S. americanum*, *S. chenopodioides*, *S. physalifolium*, *S. villosum*; Webb *et al.* 1988, p. 1240) are diploids or tetraploids (Baylis 1958, Edmonds 1977, 1986).

Total glycoalkaloid concentration was determined using standard HPLC methods (Vallin *et al.* 1996) in leaves of *S. furcatum* and some other *Solanum* species in New Zealand. The leaves of *S. furcatum* had low levels of glycoalkaloids (129 mg kg^{-1} fresh weight) relative to *S. chenopodioides* (182 mg kg^{-1} fresh weight) and *S. nigrum* (653 mg kg^{-1} fresh weight). Furthermore, the profile of peaks was different between these species. *S. furcatum* and *S. chenopodioides* did not share any compounds, whereas the two major compounds in *S. nigrum* were absent from *S. furcatum.* The very low glycoalkaloid content of *S. furcatum* leaves probably accounts for the heavy grazing by sheep observed for the population growing at Whale Bay.

Conclusions

The five populations of *S. furcatum* from the Kaikoura region of the South Island, New Zealand, occur over a 30 km range. These populations have maintained themselves for over 12 years with regular seed production and ongoing germination and establishment of young seedlings. Therefore, *S. furcatum* can be considered as having naturalised status in New Zealand. However, it is unlikely to represent an invasive threat. New individuals in populations establish as seedlings on bare sites and more mature plants are eventually overgrown by other vegetation. Gravel excavation from alongside the Hapuku riverbed, where *S. furcatum* is well established, may have resulted in seeds/plants being transported to other sites in the region. This may account for the recent roadside observations of *S. furcatum* at Goose Bay.

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